

Oct. 29, 1940.

E. T. DÉGALLIER

2,219,647

VEHICLE

Filed July 6, 1938

3 Sheets-Sheet 1

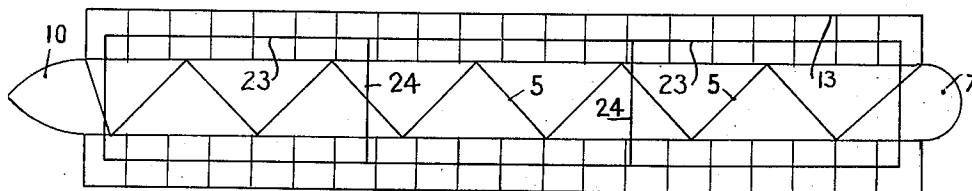


Fig. 1

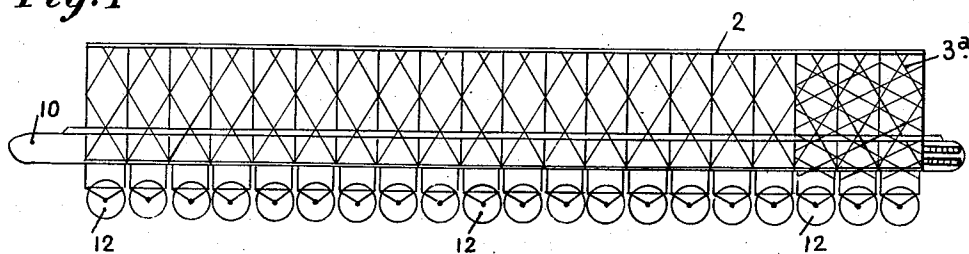


Fig. 2

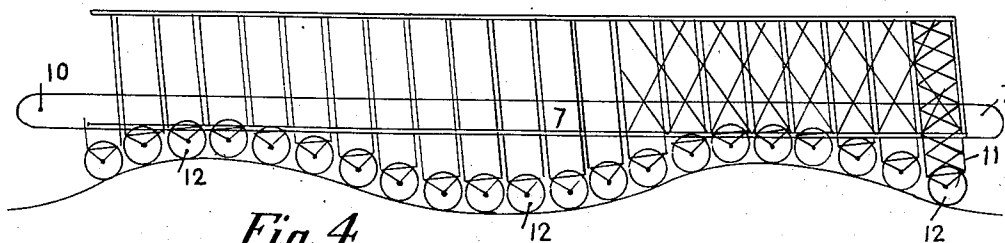


Fig. 4

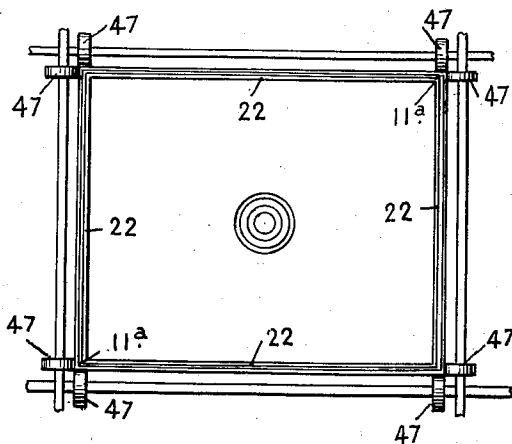


Fig. 7

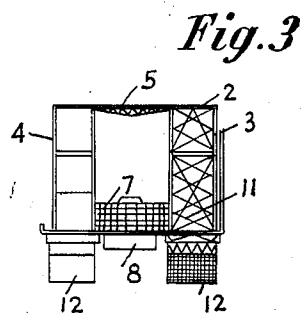


Fig. 3

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3 Sheets-Sheet 2.

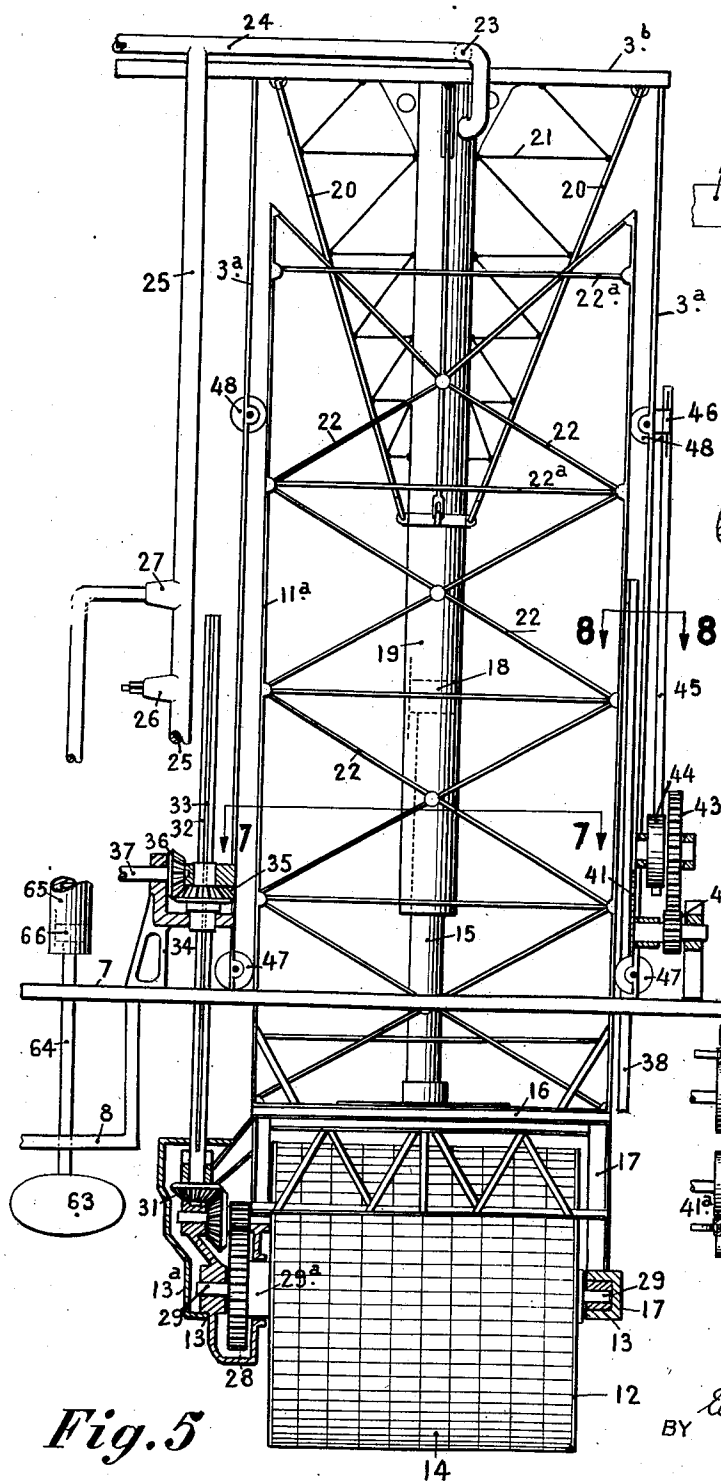


Fig. 5

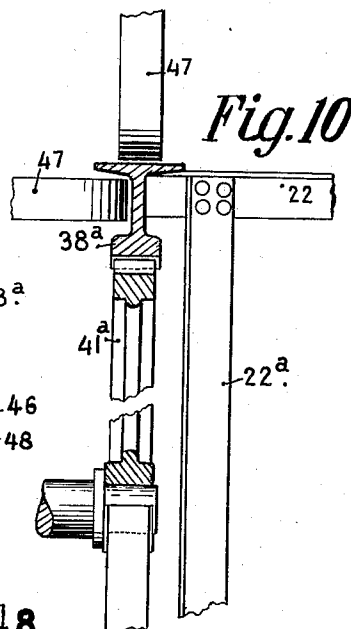


Fig. 10

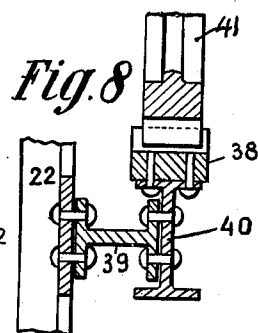


Fig. 8

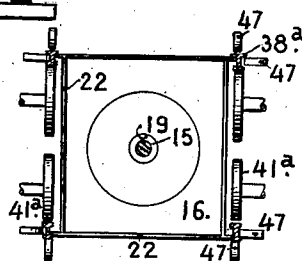


Fig. 9

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3 Sheets-Sheet 3

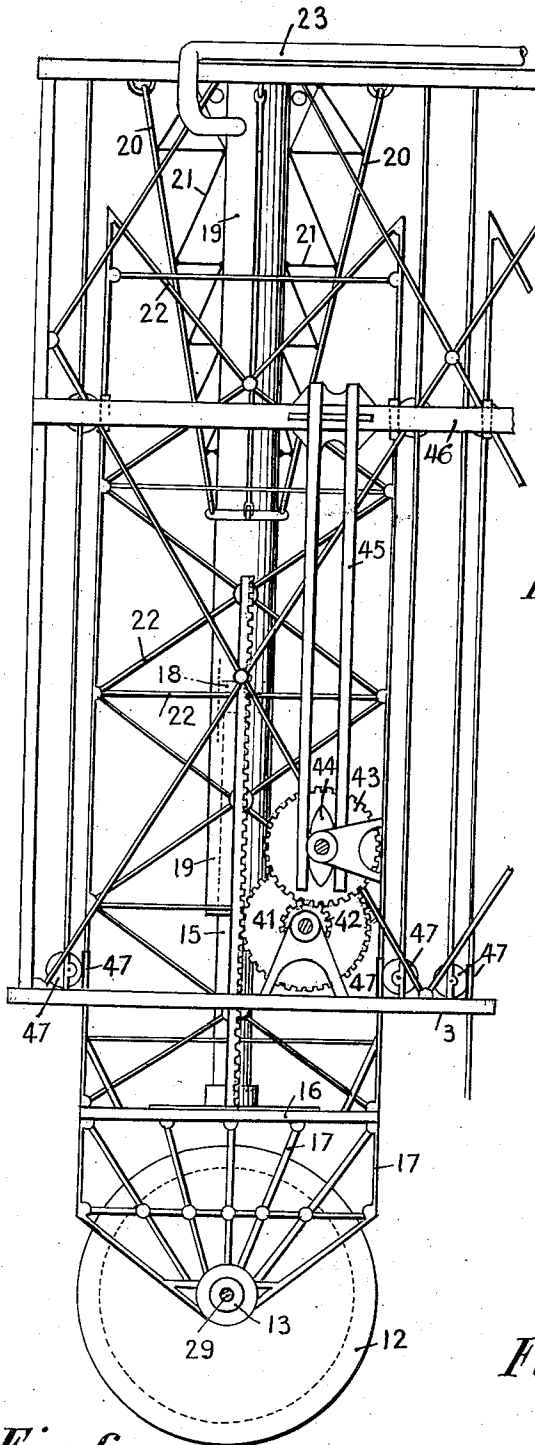


Fig. 6

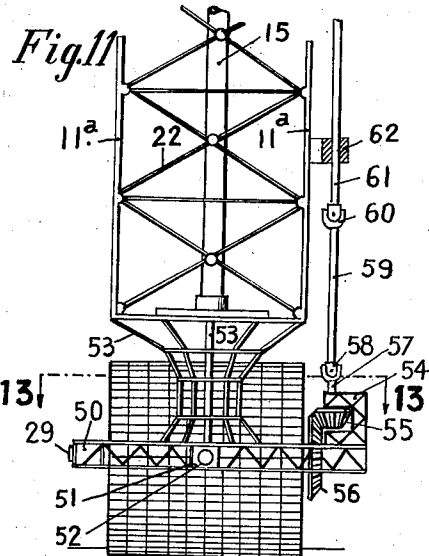


Fig. 12

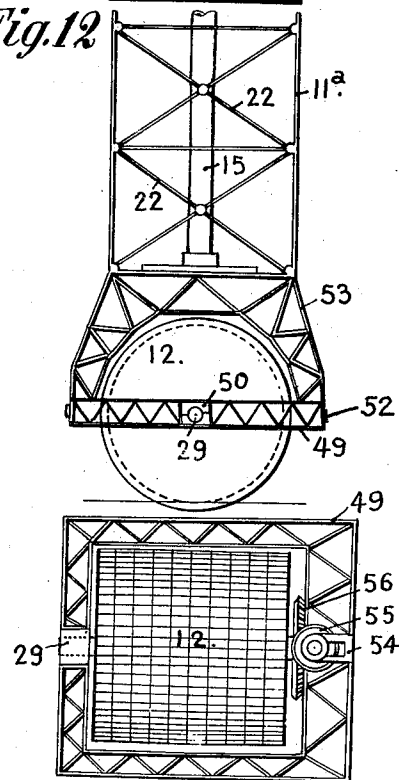


Fig. 13

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In Switzerland July 6, 1937

9 Claims. (Cl. 114—67)

This invention relates to vehicles, and more particularly to marine vessels having rotatable float members which are adapted for propelling and supporting the vessel above water.

5 One of the objects of the present invention is to provide a novel vehicle which is adapted for movement at high speed over an irregular surface.

10 Another object is to provide a novel vehicle of the above character which is capable of high speeds over heavy seas without appreciable rolling or pitching.

Another object is to provide novel means for utilizing the energy of sea swells.

15 An additional object is to provide a marine vehicle having rotatable float members and novel means for mounting said members upon the vessel.

20 The above and further objects and novel features will more fully appear from the following detailed description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for purposes of illustration only and are not intended as a definition of the limits of the invention, reference for this latter purpose being had to the appended claims.

25 In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a diagrammatic plan view of one embodiment of the invention;

Fig. 2 is a side elevation of the embodiment of Fig. 1;

35 Fig. 3 is a rear view of the parts shown in Fig. 2;

Fig. 4 is a side elevation of a second embodiment of the invention;

40 Fig. 5 is an enlarged front view of the means for mounting a float member upon the embodiments of Figs. 1 to 4.

Fig. 6 is a side elevation of the parts shown in Fig. 5;

45 Fig. 7 is a sectional view taken on line 7—7 of Fig. 5;

Fig. 8 is a detailed view of a section taken on line 8—8 of Fig. 5;

Fig. 9 is a modification of the construction shown in Figs. 7 and 8;

Fig. 10 is a detailed view of a portion of Fig. 9;

Fig. 11 is a front view of a modification of the mounting shown in Figs. 5 and 6;

55 Fig. 12 is a side elevation of the parts shown in Fig. 11; and,

Fig. 13 is a sectional view along line 13—13 of Fig. 11.

The form of the invention illustrated in the accompanying drawings, by way of example, is a marine vessel which rests in the water upon a plurality of rotatable float members analogous to those employed in the pending U. S. application Serial No. 183,278. The float members are mounted upon suitable float bearing frames which are adapted for telescopically engaging downwardly extending side frames of a chassis or frame work. The plurality of floats are enabled to follow the irregular changing surface, for example, of a heavy sea, without causing appreciable rolling or pitching of the chassis. A cylinder and piston arrangement is provided for governing the telescopic engagement of said float bearing frames with said side frames. The cylinders are interconnected by a suitable conduit system and a gaseous medium is introduced therein which assists in controlling the motion of the floats and supports the chassis. The floats are operatively connected to power means for propelling the vessel. The float bearing frames which oscillate substantially in a vertical direction may be operatively connected to means for converting this movement into power. The latter means are preferably to be operated when the vessel is at anchor whereby the energy of sea swells may be utilized.

In the form shown in Figs. 1 to 3 the vehicle comprises a rigid chassis or framework 2 having downwardly extending side frame portions 3 and 4 which extend longitudinally the full length of the vessel on opposite sides thereof. Rigid interconnecting bodies 5 and 7 are provided at the upper and lower surfaces respectively of portions 3 and 4. The lower part of body 7 is comprised by a longitudinal body 8 which is covered with sheet iron which forms stream lined portions 9 and 10 at the forward and after extremities of the vessel.

In the side frame portions 3 and 4 are mounted a plurality of float bearing frames 11 which are adapted for sliding substantially in a vertical direction (Figs. 5 to 10). These frames support at their lower part the bearings 13 of floats 12, which in the form shown, are cylindrical hollow bodies having partitions 14 forming peripheral cells contiguous to one another in which air is compressed by an effect of inertia of the water when the vessel has attained a predetermined speed at which time the vessel is lifted relative to the water, having its weight supported by the

compressed air and a vertical hydrodynamic reaction.

In the form shown each frame 11 is constituted by four vertical ribs joined by reinforcing bars 22. A rigid bottom floor 16 is secured to these vertical bars and at the center of the floor is secured a rod 15 of a piston 18 which moves within a cylinder 19. Beneath floor 16, a bearing support 17 for trunnions 29 is provided, said bearings sustaining all the weight of the frames 11 and a proportional weight of the chassis 2. The chassis is supported by means of a gaseous medium within the cylinders, preferably compressed air which is conducted to the cylinders by conduits 23 and 24. Means for securing each cylinder to the chassis are provided comprising bars 20, 21 which project downwardly into frame 11.

In order to facilitate the telescopic motion of a float bearing frame within the side frames 3 and 4, the four vertical ribs of frame 11 are adapted for engaging rollers 47 and 48 (Figs. 5 and 6), eight of the former being journalled in the lower floor 7 (Figs. 5 to 7) and eight of the latter being journalled in an upper beam 46, two rollers engaging each corner or vertical rib at each floor.

The above mentioned conduit 24 constitutes an interconnecting means for all of the cylinders 19 thereby insuring an equalization of pressure of the gaseous medium therewithin, permitting an outward stroke of one group of pistons and an inward stroke of another group when, for example, the former group is in the trough of a wave and the latter upon the crest. An inlet tube 25 connected to conduit 24 is provided having communication with a motor driven fluid pump (not shown) and having attached thereto a safety valve 26 and an inlet valve 27. The latter valve may be connected to a pump 65 which is actuated when the vessel sinks into the water a predetermined amount. The pump comprises in the form shown a piston 66 which by means of a rod 64 is connected to a float 63 situated beneath body 8. The float 63 comes in contact with the water when the vessel is at rest, at which time the cylinder 19 is close to floor 16.

Means are provided for operatively connecting float 12 with suitable power means comprising, in the form shown, a gear train within a gear box 13a, which is constituted by a spur gear 28 upon a cylindrical neck 29a of said float. Gear 28 meshes with a pinion 30 which is keyed to a bevel gear 30a. The latter meshes with a second bevel gear 31 to which is secured a shaft 32 having a longitudinal key 33 which extends the length of the shaft. Shaft 32 is keyed to a bevel 35 and is adapted for a sliding motion therethrough. Bevel 35 engages another bevel 36, which by means of a shaft 37 is connected to power means (not shown) through suitable clutch means (not shown).

It is desirable to establish a mean or reference position of the chassis relative to the floats and also to provide means for governing the period of oscillation of the floats as they follow the changing levels of the water. Such means also acts as a return mechanism to restore the above-mentioned reference position after the action of the sea or waves has altered the same. These means, in the form shown, comprise a toothed rack 38 secured to the side of the float bearing frame 11, i. e., to bars 22 by means of two vertical rails 39 and 40 (Fig. 8). Rack 38 engages a spur gear 41 on which is keyed a pinion 42 which

in turn engages a spur gear 43. A cam 44 is secured to gear 43 and is yieldingly retained in a predetermined position by means of spring bars 45 which contact said cam on opposite sides thereof and which are secured at their upper extremities to the beam 46.

The dimensions of the spring bars 45 are so calculated that the elastic reaction transmitted to the float bearing frame by means of the gear train and toothed rack 38 determines a period of oscillation of from ten to twenty seconds, for example, dependent upon the load borne by the particular piston, so that the framework 2 will have the same period of oscillation (vertical) when said spring bars act in the same direction simultaneously.

The embodiment of Fig. 4 is similar to the previously described embodiments with the exception that the float bearing frames are guided by rollers 47, 48 in a direction inclined slightly to the vertical. This direction is normal to the average acclivity of the largest waves and acts upon the device to reduce the transverse components of the forces applied to the float frames.

In operation the power means rotates the float members which propel the vessel over the water. The float members being yieldingly mounted upon the chassis will follow the motion of the waves or swells whereby the vessel remains substantially stable, thus avoiding a sudden submersion or emersion of the floats. When the vessel is riding a wave its length is sufficient to insure that there is an equal number of ascending and descending floats 12 except when the vessel is parallel to the wave's crest. The gaseous medium passes freely from the cylinders of the ascending float frames to those of the descending frames thus permitting a cushioned yielding action of the float frames. The operative connection of the power means to floats 12 remains uninterrupted despite the undulations of the floats because of the sliding shaft 32 which engages gear 35 at all times regardless of the position of the floats relative to the chassis.

When a float frame is displaced from its mid-position the cam 44 will distend bars 45 and initiate a yielding return movement of the piston 18 and the frame to the original position as shown in Fig. 6. Each cam is in its position of equilibrium when the volume of the compressed air within the cylinder is such that the pistons are in the middle of their stroke.

The load is borne entirely by the compressed gas in the cylinders and not by the return mechanism when the cam 44 is at the initial or zero position thereof (Fig. 6), a sufficient quantity of compressed gas being contained in the cylinders at this position of the cam. The return mechanism therefore is relatively lighter, and smaller than is required in road vehicles. The springs 45 tend to create a depression when there is insufficient air or gas in cylinders 19, and, in the contrary case, an excess of pressure relative to the necessary supporting pressure in the mid-position. When a sufficient number of springs act to produce an excess of pressure the valve 26 will open before the excess of gas will have elevated the frame work 2 beyond a predetermined point.

Because of the action of the yieldingly mounted float members which follow the motion of the sea it is unnecessary to make the framework 2 as rigid as the hull of a ship. Consequently, even when the vessel is at rest in calm water a certain amount of gas should remain in the cylinders 19 to prevent the lower extremity of the latter

from striking floor 15. A suitable pump, for example, pump 65 may be kept in operation for this purpose.

In Figs. 9 and 10 there is shown a variation of the toothed rack apparatus. Each float bearing frame is provided with four racks secured to its vertical corners, said racks comprising, for example, railroad rails each of which engages guide wheels 47 and meshes with a spur gear 41a, the latter gear being operatively connected to a return mechanism as described in connection with Fig. 6.

Figs. 11 to 13 show a second form of mounting the floats 12 upon the float bearing frames 11. This mounting permits a transverse inclination of the floats and comprises a support ring 49 in which are secured bearings 50 for the trunnions 29. Axially perpendicular to trunnions 29 are bearings 51 in which are journaled trunnions 52 which are secured to a framework 53 surrounding the upper half of float 12. Support ring 49 is adapted also for supporting bearings 54 of a bevel gear 55 which engages another bevel 56 keyed to the float.

Gear 55 is connected to a power shaft 61, which rotates in a bearing 62, by means of a double universal joint 58, 60 having a shaft 59. Joint 58 is connected to gear 55 by means of shaft 57.

A compression chamber (not shown) may be placed in communication with the conduit system in order to increase the volume thereof, in order to prevent the formation of an excessive pressure, for example, as in the case of a vessel smaller than a wave length where all the pistons 18 would rise suddenly upon encountering a wave. Such a chamber would also diminish the loss of air through valve 26.

A wind from the port side will cause a list to starboard, a submersion of the starboard floats, and consequently a change of course to starboard. Suitable means may be provided for compensating for this yawing effect comprising, for example, a rudder which may be constituted by a rotatable float similar to float 12 but which may be turned about a vertical axis upon a suitable mounting situated preferably at the rear of the vessel.

Instead of employing a rudder the yawing of the vessel when listing may be compensated by speeding up the overloaded floats or by employing one or more gyroscopic stabilizers which may be mounted preferably amidship.

There is thus provided a novel vehicle which is especially adapted for use as a marine vessel. The vessel is capable of high speeds, i. e., from approximately 60 to 180 miles per hour, in heavy seas with almost a complete absence of rolling and pitching. The vessel, furthermore, is easily maneuvered and meets with only a small hydrodynamic resistance as compared to that met by ordinary vessels.

Although only two embodiments of the invention have been illustrated and described in detail it is to be expressly understood that the invention is not limited thereto. For example, the apparatus may be employed as a land vehicle as well as a marine vessel, provided suitable changes are made in the rolling surfaces or floats 12 to adapt the same for land. It is also possible to employ the device as a buoyant installation which may be attached to suitable fixed guides, the latter being anchored to the bottom of the sea in such a manner that the float members, which will undulate with the motion of the water, will be able to transfer the energy of the sea swells to suitable power generating means. The valve 27

might also be connected to a pump which in turn may be actuated by the axial oscillations of shaft 32 not only while under way but when at rest. Various changes may also be made in the design and arrangement of the parts without departing from the spirit and scope of the invention as the same will now be understood by those skilled in the art. For a definition of the limits of the invention reference will be had primarily to the appended claims.

I claim:

1. In a vehicle of the class described, a rigid framework, a plurality of cylinders attached to said framework, a piston having a piston rod in each of said cylinders, means for forcing a gaseous fluid into said cylinders, a float member rotatably mounted upon each of said piston rods, means for maintaining the axes of rotation of said float members in parallel relationship, and means for governing the period of oscillation of each of said pistons.

2. A vehicle of the class described comprising a rigid framework, a plurality of cylinders secured to said framework, a piston in each of said cylinders, a float bearing frame operatively connected to each of said pistons, means for maintaining said bearing frames in parallel relationship, a float member in each float bearing frame, a conduit interconnecting said cylinders, a fluid pump in communication with said conduit, and a return mechanism operatively connected to each of said bearing frames.

3. The combination with a framework of a plurality of cylinders secured to said framework, a conduit system interconnecting said cylinders, a pump means in communication with said conduit system, a piston for each of said cylinders, a float bearing frame for each of said cylinders operatively connected to each of said pistons, a rotatable float member for each of said float bearing frames, power means for rotating said float members, means for constraining said float bearing frames to move longitudinally and in parallel relationship to one another, and means for governing the longitudinal oscillations of said float members.

4. In apparatus of the class described, a framework, a plurality of cylinders having pistons, said cylinders being secured to said framework, a plurality of buoyant float members, each member being mounted upon one of said pistons, a conduit system interconnecting said cylinders, means for maintaining a gaseous fluid under pressure in said system and cylinders, means for constraining the oscillating motion of said float members in a substantially vertical direction, a plurality of return mechanisms, each being operatively connected to one of said pistons, and power generating means operatively connected to said pistons, the latter means being operable by an oscillating motion of said float members.

5. In a vehicle of the class described, a plurality of rotatable float members, each of said members comprising a hollow watertight body and external partitions secured to said body forming peripheral compartments thereon, said compartments being open at the outer faces thereof, a plurality of float bearing frames, the floats being mounted in the frames, a chassis, means for mounting said float bearing frames upon said chassis whereby the frames are adapted for oscillatory movement relative to the chassis, power means, and means for operatively connecting said power means to each of said float members.

6. In a vehicle of the class described, a plurality of rotatable float members, each of said members comprising a hollow watertight body and external partitions secured to said body forming peripheral compartments thereon, said compartments being open at the outer faces thereof, a chassis, a float bearing frame for each of said float members, a plurality of cylinders secured to said chassis, a piston for each of said cylinders, each of said bearing frames being operatively connected to one of said pistons, and means for mounting each of said float members upon one of said float bearing frames whereby each of said members is adapted for movement about an axis perpendicular to the axis of rotation of the float member.

7. A vehicle of the class described, a rigid framework, a plurality of cylinders attached to said framework, a piston having a piston rod in each of said cylinders, means for forcing a gaseous fluid into said cylinders, a float bearing frame secured to each of said rods, each of the float bearing frames being adapted for telescopically engaging the rigid framework and being in the form of a prism, guiding means upon the framework at a predetermined level thereon for each of said frames, and guiding means for each of the frames upon the framework at one or more other predetermined levels thereon.

8. In a vehicle of the class described, a rigid framework, a plurality of cylinders secured to said framework, a piston in each of said cylinders, a float bearing frame operatively connected to each piston, a float mounted upon each of the float bearing frames, the dimension of each of the float bearing frames measured in the direction of advance of the vehicle being substantially equal to the diameter of the float mounted thereupon, a conduit interconnecting said cylinders, and a fluid pump in communication with said conduit.

9. In a vehicle of the class described, a rigid framework, a plurality of cylinders secured to said framework, a piston in each of the cylinders, a float bearing frame operatively connected to each piston, a cylindrical float mounted upon each frame, each of the latter comprising a prismatic structure having transverse cross-sectional dimensions of width and length respectively which are substantially equal to the diameter and length of the cylindrical float member mounted thereon, each of said frame members extending to the axis of rotation of the float member mounted thereon in order to meet horizontal forces acting upon the float, and a conduit interconnecting said cylinders.

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